

# AC' 97 System BIOS Codec/Function Detection Algorithm

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## Introduction

In an Intel® 82801AA/AB based platform the system BIOS is required to detect the AC' 97 codec configuration and topology previously to PCI enumeration procedures to properly initialize and program the PCI Sub-System ID in the audio and modem functions configuration space. The following paragraphs describe an algorithm to facilitate this detection and configuration process. The following table provides the current available PCI Device ID for the Compatible Intel AC'97 2.1 Controllers.

### Applicable Components

Device Name	Vendor ID	Device ID	Subsystem Vendor ID	Subsystem Device ID	Base Class Code	Sub-Class Code	Prog. Interface	Revision ID	Bus Number (PCI Addr)	Device Number (PCI Addr)	Function Number (PCI Addr)	Microsoft PNP Device Node ID	Intel Desired Device Description (INF name) Name for: Windows 95* Windows 98* Windows NT*
ICH	8086	2415	Default is 00h. Value of this register varies according to the system	Default is 00h. Value of this register varies according to the system	04h	01h	00h	ALL	00h	1Fh	5	PCI\VEN_8086&DEV_2415 (subsystem will also provide additional information)	Intel(r) 82801AA AC '97 Audio Controller (displayed by driver provider's INF)
ICH	8086	2416	Default is 00h. Value of this register varies according to the system	Default is 00h. Value of this register varies according to the system	07h	03h	00h	ALL	00h	1Fh	6	PCI\VEN_8086&DEV_2416 (subsystem will also provide additional information)	Intel(r) 82801AA AC '97 Modem Controller (displayed by driver provider's INF)
ICH-0	8086	2425	Default is 00h. Value of this register varies according to the system	Default is 00h. Value of this register varies according to the system	04h	01h	00h	ALL	00h	1Fh	5	PCI\VEN_8086&DEV_2425 (subsystem will also provide additional information)	Intel(r) 82801AB AC '97 Audio Controller (displayed by driver provider's INF)
ICH-0	8086	2426	Default is 00h. Value of this register varies according to the system	Default is 00h. Value of this register varies according to the system	07h	03h	00h	ALL	00h	1Fh	6	PCI\VEN_8086&DEV_2426 (subsystem will also provide additional information)	Intel(r) 82801AB AC '97 Modem Controller (displayed by driver provider's INF)

### Pre-Boot PCI Audio/Modem Enabling Matrix

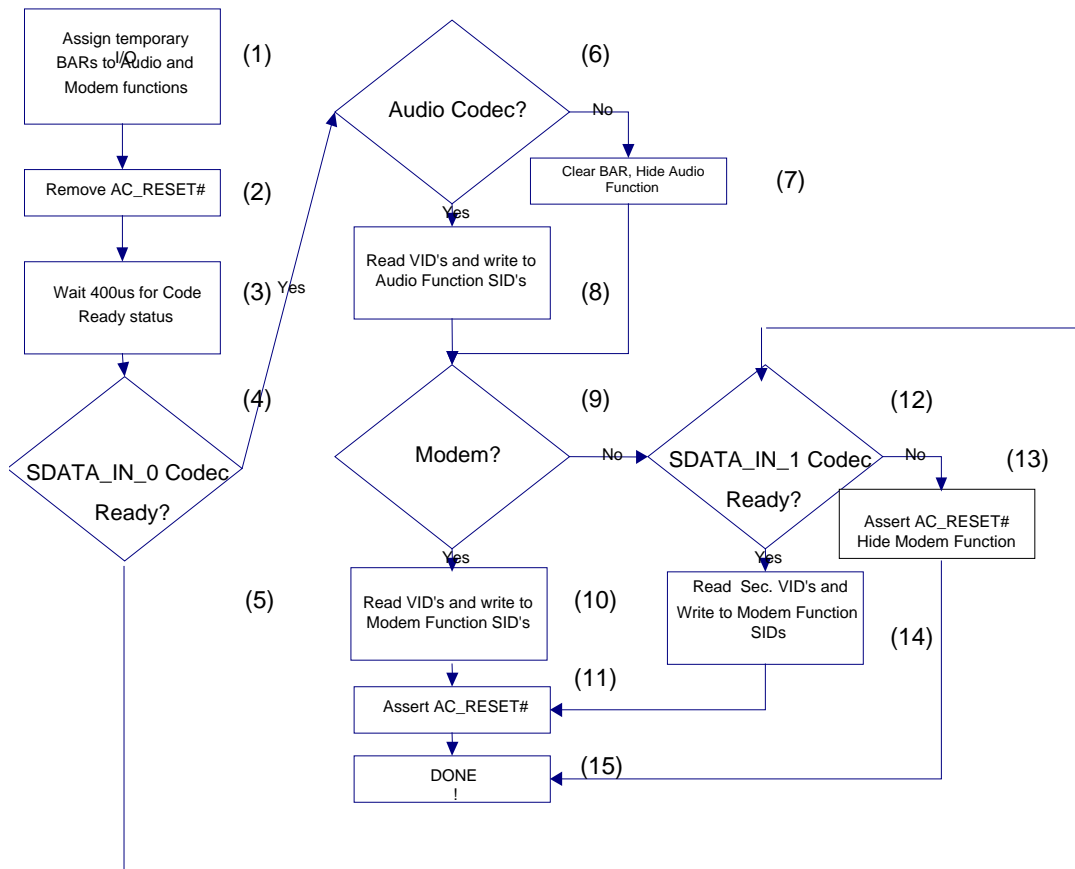
During POST and before PCI enumeration BIOS should determine codec configuration and disable PCI Audio or Modem as shown in table below. Disabling here refers to remove the function from PCI configuration space. In this mode the device will not respond to any type of access.

Configuration Vs. Function	#0 No Codec	#1 Single Audio Codec (SDATA_IN_0)	#2 Single Modem Codec (SDATA_IN_0/1)	#3 Single Audio/Modem Codec (SDATA_IN_0)	#4 Dual Codec Audio(SDATA_IN_1) Modem (SDATA_IN_1)
Audio Function	Disable ✗	Enable ✓	Disable ✗	Enable ✓	Enable ✓
Mmodem Function	Disable ✗	Disable ✗	Enable ✓	Enable ✓	Enable ✓

**Table 1: PCI Functions Enable/Disable**

### Codec/Functionality Detection Algorithm

The following flow diagram represents the steps required to detect the codec configuration attached to the AC Link.



**Important Note:** To understand the following steps it is necessary to follow the algorithm above. The numbers in each item represent specific steps in the algorithm.

1. BIOS assigns a temporary I/O address to the BARs for audio and modem devices and enables I/O decoding in the command register:
2. BIOS removes AC\_RESET# in the AC link.

3. Wait for 600 ms to allow for codec internal initialization and return of “Codec Ready” signal
4. Read status for SDATA\_IN\_0
5. If no codec ready, then there are no codec attached to SDATA\_IN\_0, as audio should be attached to SDATA\_IN\_0, there is not audio codec. BIOS needs to clear the BAR’s assigned to the PCI audio function and remove it from configuration space. BIOS then checks for SDATA\_IN\_1 (see step 12)
6. If there is a codec attached to SDATA\_IN\_0, then BIOS needs to determine if the codec is and audio codec (AC). To determine this, BIOS writes 8000h (default value) and reads back the Master Volume register in Audio Mixer space in the PCI audio Function. BIOS should save the original value in this register and restored after this operation to prevent issues during a re-initialization after a power saving event.
7. If no audio codec function is detected, BIOS needs to clear the BAR’s assigned to the PCI audio function (see item #1) and remove the same PCI audio function (see item #5.)
8. If the audio function is detected, BIOS will read the Primary Codec AC’97 vendor IDs in register 7Ch and 7Eh. BIOS will uses these values to program the Subsystem Vendor ID and Subsystem ID in the audio PCI configuration space registers SVID: 2Ch-2Dh and SID: 2Eh-2Fh (See section 4Details on AC’97 ID Space).
9. It is also required to determine the presence of a modem function in SDATA\_IN\_0 codec. This will indicate the presence of a Modem codec (MC) or an Audio/Modem (AMC) codec (pending previous determination of audio presence.) To determine Modem function presence the BIOS will read the Extended Modem Register in the Modem Function I/O space and verify that D15 and D14 (ID1, ID0) are clear “0” value and D0 (LIN1) is set to “1”.
10. If the modem function is detected, BIOS will read the Primary Codec AC’97 vendor ID’s in register 7Ch and 7Eh. BIOS will uses these values to program the Subsystem Vendor ID and Subsystem ID in the modem PCI configuration space registers SVID: 2Ch-2Dh and SID: 2Eh-2Fh.  
**Note: The AC ‘97 VID registers are at the same offset for the codec regardless of audio or modem capabilities.**
11. Assert AC\_RESET#.
12. Read status for SDATA\_IN\_1 codec.
13. If no codec is detected in SDATA\_IN\_1, BIOS needs to generate an AC\_RESET# (see item #2), clear the BAR’s assigned to the PCI modem function (see item #1) and remove it from PCI configuration space. (See item #5.)
14. If the codec is present in SDATA\_IN\_1 BIOS will read the Secondary Codec AC’97 vendor ID’s in register FCh and FEh. BIOS will uses these values to program the Subsystem Vendor ID and Subsystem ID in the modem PCI configuration space registers SVID: 2Ch-2Dh and SID: 2Eh-2Fh (See section A.4.Details on AC’97 ID Space)
15. Configuration Completed!



### Details on AC'97 ID Space

The AC'97 specification allows for two 16-bit sets of Vendor Specific ID's

BIOS should read the codec VID1 and VID2 and used it as reference into a lookup table to determine:

1. Subsystem Vendor ID (PCI SIG assigned number to the codec, AMR or Motherboard manufacture) and
2. Subsystem ID (Motherboard raiser and/or codec device ID)

These register programming are required for proper device driver enumeration and loading. The entries in the lookup table will vary pending the OEM integration and sourcing requirements. In the audio function programming the VID2 value into the Subsystem ID could be sufficient to fulfill step 2 above. However, for modem raiser SKUs the codec ID is not sufficient and OEM should provide a unique serialization of the Subsystem ID for the modem raiser.

Reg	Name	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	Default
7Ch	Vendor ID1	F7	F6	F5	F4	F3	F2	F1	F0	S7	S6	S5	S4	S3	S2	S1	S0	na
7Eh	Vendor ID2	T7	T6	T5	T4	T3	T2	T1	T0	REV7	REV6	REV5	REV4	REV3	REV2	REV1	REV0	na

**Table 2: Codec Vendor ID registers**